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HEREDITARY RESEMBLANCES IN THE BRAINS OF THREE BROTHERS[1]

By EDWARD ANTHONY SPITZKA

To demonstrate the influence of heredity in the configuration of the human brain has long been the wish of brain anatomists. A few cases of brains of new-born twins and triplets are on record,[2] but owing to the comparatively primitive degree of individual differentiation in the disposition of the cerebral fissures and gyres in the brains of the new-born, no safe conclusion could be reached. No adequate adult material of this kind has been described except the brains of the two distinguished physicians Seguin, father and son, which it was the writer's good fortune to obtain for comparative study four years ago.[3] It may be mentioned here that in the Seguin brains I attributed certain interesting points of resemblance to hereditary transmission. I again had the good fortune to test the question of encephalic morphological transmission in the brains of three brothers who were recently executed together for a murder in New York state. Through the kindness of the prison officials, notably Mr George Deyo, the warden, and Dr J. B. Ransom, the prison physician, it was my privilege to perform the autopsies, and I naturally

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[1] Read before the Association of American Anatomists, Seventeenth session, Philadelphia, Pa., December 29, 1903.

[2] N. Rüdinger, Ueber die Hirne von Zwillingen, *Anat. Anz.*, Ergänzungsheft. z. IX Bd., 1904, p. 177. G. Retzius, *Das Menschenhirn*, Stockholm, 1897, Text, p. 90. Waldeyer, Ueber Gehirne von Drillingen, *Correspondenzbl. d. deutsch. Ges. f. Anthropol., Ethnol. u. Urgeschichte*, XXXIII, 11 u. 12, Nov.-Dec., 1902, p. 128.

[3] E. A. Spitzka, A Preliminary Communication of a Study of the Brains of Two Distinguished Physicians, Father and Son, *Proc. Assoc. American Anatomists*, Fourteenth session, 1900, pp. 70–92; *Phila. Med. Jour.*, VII, No. 171, April 6, 1901, pp. 680–688. E. A. Spitzka, The Redundancy of the Preinsula in the Brains of Distinguished Educated Men, *N. Y. Med. Record*, LIX, No. 1597, June 15, 1901, pp. 940–943. Since the publication of my paper on "Three Eskimo Brains" (*American Journal of Anatomy*, vol. II, No. 1, pp. 25–71, 1902), I have been informed by Lieutenant Peary that "Nook-tah" and "Ah-wee-ah" were father and daughter. As in the case of the Seguins, the absence of the other parent's brain seriously interferes with the search for conclusive evidences of hereditary transmission.

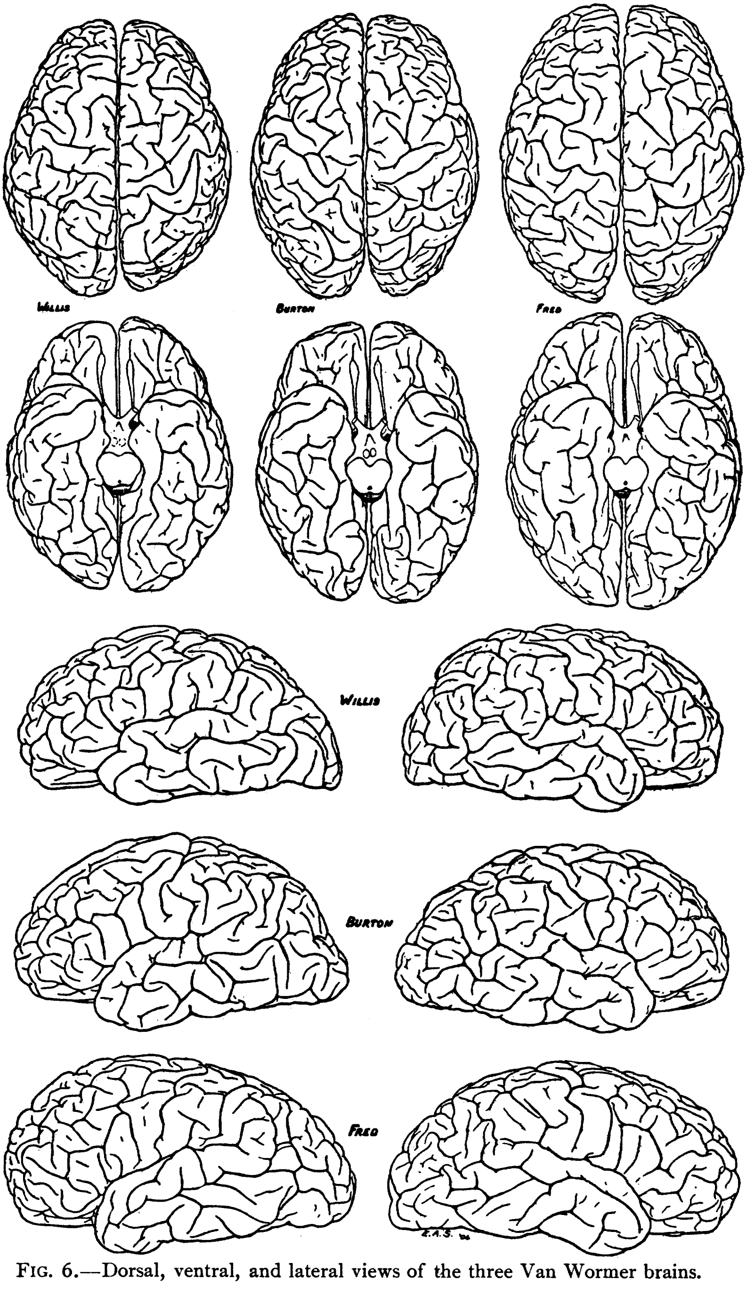

FIG. 6.—Dorsal, ventral, and lateral views of the three Van Wormer brains.

directed my attention especially to the brains. The opportunity afforded by this triple execution was certainly most rare, and a similar case will not soon occur again, unless it be during some widespread epidemic of a fatal disease, or in the course of an overwhelming catastrophe.[1]

To doubt that heredity plays an important rôle in the development of the brain were to cast aside a vast array of facts which prove any portion of the body-structure to be rigorously limited by this factor. The transmission of ancestral conditions is a matter of everyday observation, if we but compare the physical and mental traits of blood relatives. If we recall the many families of musicians, families of linguists, families of biologists; or the French orphan child mentioned by Darwin as having been brought up out of France, yet shrugging like his ancestors; or recalling, on the other hand, those sad cases of transmission of insanity, of alcoholism, of epilepsy, in short, of most any kind of disease or defect, the far-reaching importance of this life-force must be manifest to everyone. Nevertheless, the problem of why "like begets like" is one of the most complex topics of biology. With this, the anatomical structure of the human brain is the most complex of all the organs. The study, then, of "brain-heredity" were difficult enough if more material were at hand. Our inquiries in this direction are rendered still more difficult by that other great though not yet thoroughly understood law of organic evolution — the law of variation. If no two animals and no two plants can be said to be exactly alike, this is certainly true of the brains of men. The surface of the human brain, while it is patterned in accordance with a general groundplan presenting the same essential features in all normal brains, yet shows, if examined in detail, many differences recognizable not only in the brains of different races and individuals, but also in the two cerebral halves of the same individual. The primary fissures and certain other stable formations of the cerebrum do not exhibit many marked modifications in different brains. But there are other parts subject to great range of variation — parts which, morphologically speaking, are in a state of " unstable equilibrium " in the evolutionary process. Peculiarities of anatomical configuration of this class, uncommon enough in the general run of brains as they come to the hands of anatomists, if similarly reproduced in the brains of blood-relatives may, I think, be confidently brought forward as evidences of hereditary resemblance. Such evidences were found in the brains of these three brothers, and I shall here call attention to some of the points sustaining this proposition.

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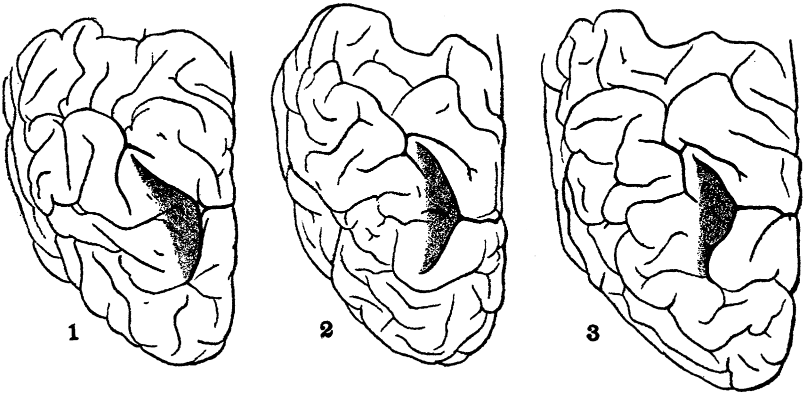
[1] The writer has recently learned of the acquisition, by Professor L. F. Barker of Chicago, of the brains of two brothers in Dr Sanger Brown's series of hereditary ataxia (*Proc. Association of American Anatomists*, Sixteenth session, 1902). It is also possible that the brains of Dr C. H. E. Bischoff and his son, the anatomist, T. L. W. Bischoff, have been preserved in the Munich collection.



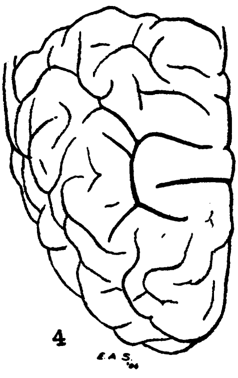


FIG. 7.—Showing the unusual form of the paroccipital fissure (left side) confluent with the occipital, separated from the parietal by a slightly depressed paroccipital isthmus, and characterized in each case by an operculation, indicated by the shaded portion. The fourth figure shows the usual arrangement.

It may as well be stated here that while the brothers resembled each other in outward physiognomy as well as in general physique, they differed with reference to the size of the head, although the conformation was quite similar. It was found that the youngest of the three had the largest head and the heaviest brain, while the eldest had the smallest head and the lightest brain.[1] In the absence of an anthropometric life-record it is impossible to say to what this difference in head-size and brain-weight is actually due. The more likely explanation may be found in the fact that there had occurred a somatic improvement with each successive birth, expressed by a larger size of the head in the third as compared with the first born.

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[1] The anthropometric data in these cases are given in the writer's report of the post-mortem examination in *The Daily Medical*, vol. 1, No. 1, Feb. 8, 1904, and, briefly, in *Science*, Nov. 27, 1903, p. 699.

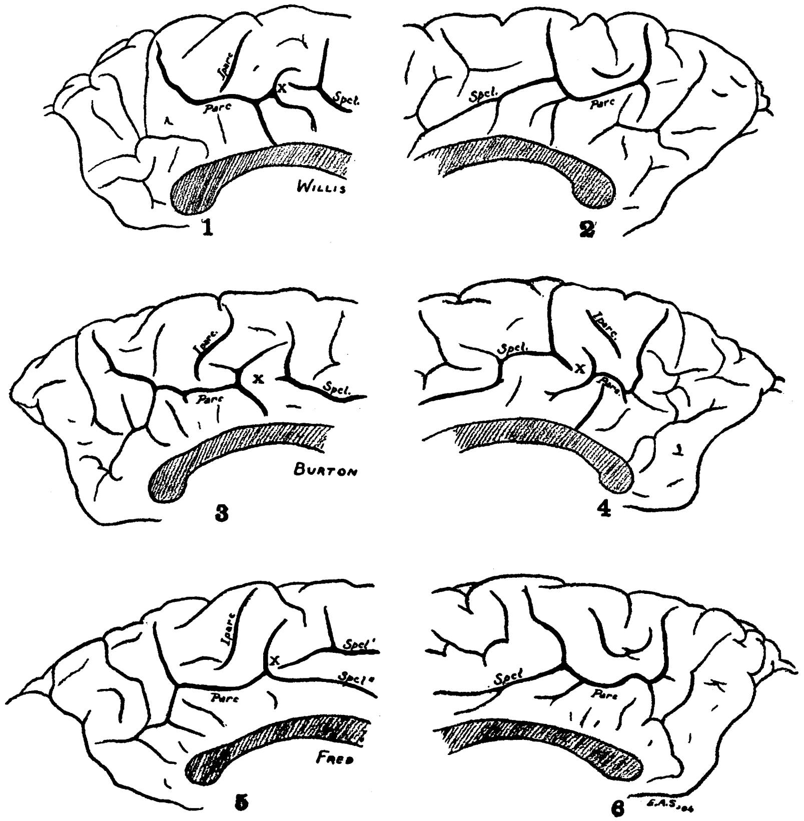

FIG. 8.—Mesal view of paracentral region of both hemicerebra in the three brains Note separation of the paracentral fissure (*Parc.*) from the supercallosal (*Spcl.*) in four (1, 3, 4, 5) of the six hemicerebra, while the remaining two (2 and 6) resemble each other. Note also the oblique intraparacentral in 1, 3, 4, and 5, while in 2 and 6 there is a curved element.

The form of the brains, like that of the heads, is similar in all three (fig. 6); viewed dorsally, the narrower and less bulging left frontal lobe is seen to be a characteristic feature in all three brains;

this is particularly marked in Willis, the eldest. The relative proportions of the various cerebral parts are much the same as ascertained by careful measurements. Although the cerebra differ in absolute size, the callosum is of exactly the same length in all three; nor do the dimensions of the cerebellum and pons differ materially in the three.

To come to the details of the cerebral markings, I wish to call attention to the similarity of the gyral physiognomy — a similarity which would appeal to the average skilled observer if they were placed in juxtaposition with, say, any other three brains taken at hazard. Further than this, however, I desire to point out (fig. 7) the unusual form of the paroccipital fissure, confluent with the occipital by the cephalic stipe, separated from the parietal fissure by a slightly depressed parocciptal isthmus, and characterized in each case by an operculation, i. e., the subparietal portion tends to lap over the paroccipital gyre. I do not recall ever having seen quite such a formation in over two hundred brains carefully examined in this region in particular, and its recurrence upon the same side in the brains of three brothers, born, respectively, four and two years apart, is certainly striking. Yet further we note (fig. 8) the separation of the paracentral from the supercallosal in four of the six hemicerebra, while the remaining two resemble each other. Other similarities are to be found in the disposition of the left superfrontals, and of the right supercentrals, with adjacent paramesial elements. The right postcentral fissures are almost exactly alike in two (Willis and Fred). The combination of these with other minor similarities lend great weight to the supposition that they are hereditary signs and not fortuitous.